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Science Serves In War

Q. B. Hamilton



*Maryland stockmen view the results of cattle feeding experiments.*

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FIFTY-SIXTH ANNUAL REPORT  
OF THE  
AGRICULTURAL EXPERIMENT STATION

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UNIVERSITY OF MARYLAND  
COLLEGE PARK, MARYLAND

1942-1943

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Visitors will be welcome at all times, and will be given every opportunity  
to inspect the work of the Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge  
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*To the Governor of Maryland, the Board of Regents,  
and the President of the University of Maryland:*

I transmit herewith the Fifty-Sixth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1943, and a statement of the receipts and disbursements for the same period.

R. B. CORBETT,  
*Director.*





# UNIVERSITY OF MARYLAND

## AGRICULTURAL EXPERIMENT STATION

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Volume 56

1942-1943

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### Science Serves In War

Being

#### The Fifty-Sixth Annual Report

For the Fiscal Year Ending June 30, 1943.

*By R. B. CORBETT, Director*

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**A**GAIN, as in several years past, this report presents in popular style results of Station findings for the fiscal year ending June 30, 1943. Studies which are completed or which have reached definite milestones of progress are presented in detail either in Station bulletins or in scientific journal articles. Those which have not reached that stage of progress, but in which findings of interest have been made, are presented herewith in the form of progress reports. In keeping with the policy which has been adopted for the war period, long-time studies or others from which immediate contributions to the war effort cannot be expected are held relatively inactive, while those are pushed which give promise of immediate beneficial results.

The lines of study that have been stressed include the most efficient utilization of plant proteins to replace those of animal origin in rations for hogs and poultry. They include also the effectiveness with which such commercial plant products now on the market have been processed in manufacturing to permit their efficient use as substitutes for animal proteins. Much time has been devoted to methods of storage and processing of vegetable products to obtain their greatest palatability and nutritional qualities. The results of some of these emergency studies have contributed much to the more abundant and more efficient feeding of both our armed forces and our civilian population during this period of emergency.

## ECONOMIC FACTS ON MARYLAND FARMING

### FARM ORGANIZATION AND MANAGEMENT

**Dairy Farm Returns**—Why some dairy farmers make money and others fail can best be answered by careful analysis of the farm business. A comparison of records of identical farms for 1941 and 1942 shows an average net farm income of \$2,367 in 1941 and \$2,958 in 1942, an increase of \$571, or 24 percent. Farmers used some of the increased income to improve their credit status by paying an average of \$186 more per farm on debts than was paid in 1941. Not all dairy farms, however, made this good showing. The most profitable farms had greater labor efficiency, larger milk production per cow, lower cost per gallon of milk sold, larger crop yields per acre, and greater cash receipts in relation to total investment than was true of the least profitable farms.

**Raising Dairy Heifers**—There are about 212,000 dairy cows on the farms of Maryland, and about 42,000 dairy heifers must be raised or purchased annually for normal replacements in the herds. These replacements must be of high quality and must be supplied regularly to insure the industry's perpetuation.

Records were taken on 200 farms in the four leading dairy counties of the State—Frederick, Carroll, Harford, and Montgomery—to secure facts on the status of dairy herd replacements in Maryland; methods of determining needed replacements; cost of raising heifers to maturity; and the advisability of raising heifers as compared with purchasing needed replacements.

It was found that the cost of producing a heifer was not the only factor considered by farmers in deciding whether to raise or buy replacements. Reasons given for raising them showed that home-grown replacements were superior to those purchased, a large cash outlay was avoided, the chance of bringing disease into the herd was eliminated, and farmers were enabled to follow a definite program for improving the quality of their herds.

**Wartime Farm Production in Maryland**—Through conferences with farmers in all regions of Maryland, information was assembled regarding the 1942 food production situation, feasible production for 1943, and the main obstacles to be encountered in achieving the desired wartime production of agricultural products. This information was used in establishing production goals by counties and areas in 1943. Maryland farmers were assisted in directing their efforts toward producing more of the commodities needed in the Food-For-Freedom program.

Farmers were confronted with difficulties in achieving maximum production because of increasing costs; shortage of labor; insufficient harvesting machinery; shortage of machinery parts; inadequate storage facilities; scarcity of containers for fruits.

vegetables, and eggs; and problems in transportation. They are willing and anxious to do their full share in helping to win the war and are increasing their production in the face of many obstacles. It will not be possible, however, to make the same percentage increase in 1943 and 1944 as was made in 1942, because farmers are reaching their production capacities in many respects.

**Farm Machinery Supplies**—Farm labor shortages and prospective acreage increases in essential crops emphasize the need for power and time-saving machinery and equipment.

An inventory of machinery on farms, by age and condition, was obtained for 1,518 farms, and by appraised value from 1,543 farm loan records.

The number of tractors on farms in the State in 1942 was estimated at 16,800, of which 16,000 were in usable condition. About 4,000 additional tractors are needed to replace obsolete and inefficient tractors, to replace the gradual decrease in horses on farms, to replace tractors exhausted from use, and to make available tractors for many large farms having no tractors.

Wagons were the most numerous of the heavier types of machines, there being 37,000 in Maryland. In general, the machines with greatest labor-saving possibilities were in best condition. There were 54,100 one-horse cultivators, and several other light types of implements were nearly as numerous. More than 75 percent of the side-delivery rakes, hay loaders, corn harvesters and milking machines, and two-thirds of the tractors and tractor-drawn implements were on farms of 100 acres and over.

About 4,000 additional milking machine installations should meet the needs of the 6,800 dairy farmers having herds of 10 or more milk cows. It is doubtful if crop use will warrant more than 1,500 combines, 1,000 pick-up balers, and 500 corn pickers in Maryland. Requests for increased potato acreage warrant an increase in the number of potato diggers from 2,000 to 2,800.

There are many types of labor-saving farm equipment which could serve to increase farm production. An increase of 2,000 gasoline engines, 5,000 electric motors, and 1,000 wood-saw rigs could be used to advantage.

**Trends in Maryland Agriculture**—Agricultural trends in Maryland from the earliest date statistics were reported by the U. S. Department of Agriculture to the present time are portrayed in a hand-book that has been prepared. It brings together all data relating to acreage, production and value of crops; numbers, production and values of livestock; real estate values; prices received by farmers; income from farm marketings and government payments; and other data on Maryland agriculture.

Production trends indicate material shifts in the agricultural pattern of the state. Substantial decreases have occurred in horses, mules, sheep, corn, wheat and oats. Upward trends are indicated in dairying, poultry production, barley, soybeans, and vegetables for processing.

### FARM LABOR PROBLEMS

Deferment of many farm workers by Selective Service Boards, return of some farm-trained men from industries, release of persons over 38 years old from the Army, and transfers from non-essential occupations to agricultural work have helped the farm labor situation. The situation is still critical, in spite of all efforts to alleviate the farm labor shortage. The most acute shortages of farm labor in 1943 will be in the seasonal truck crop, canning and fruit areas, although less critical shortages will occur in connection with harvesting tobacco, corn and hay. August and September, during the harvesting and canning of the tomato crop, is expected to be the period of most serious labor shortage.

About 83,000 persons will be required to produce and harvest farm crops and care for livestock in Maryland at the peak of the 1943 season. In addition to the number now on farms, there will need to be employed 1,800 permanent year-round workers, 5,000 summer month workers, and 12,000 seasonal workers. About 14,000 of these will have to be mobilized from local sources and 4,800 recruited from other sources, mainly from outside the state.

To determine the labor requirements on farms, studies were made of the actual hours of labor used on each farm enterprise.

**Selected Crops**—The hours of labor required to produce crops were: Corn for grain, 50.3; corn for silage, 40.9; wheat, 11.4; barley, 10.4; winter oats, 6.9; spring oats, 14.1; rye, 10.1; tobacco, 274.5; mixed hay, 7.9; alfalfa hay, 20.7; soybeans for hay, 16.9; soybeans for grain, 7.9; early potatoes, 73.5; late potatoes, 98.4; sweet corn, 30.6; tomatoes for canning, 169.6; snap beans for canning, 154.7; peas for canning, 24.0; strawberries, 284.7; and cantaloupes, 167.7.

**Livestock**—Wide variation was found in the hours of labor used to care for livestock. This variation is caused by differences in size of enterprise, amount and kind of equipment used, and practices followed in production. The study showed that some farmers are producing with half the amount of labor used by their neighbors and are maintaining production.

The total average hours of labor used annually to care for a head of livestock was: Horse, 103.7; beef cow, 15.1; milk cow, milked by machine, 162.1; milked by hand, 196.4, average, 186.0; brood sow, 33.5; fattening hog, 12.0; mature chickens (100 layers), 224.8; and chickens raised (per 100), 52.0.



**Canning Plants**—Information regarding the number of employees used in canning plants and the capacity of the plants to handle the volume of crops requested under the production goals program was obtained as a guide in effectively recruiting the necessary labor.

About 26,000 persons were employed in canning plants in Maryland in 1942 at the peak of the season. About 80 percent of the laborers in canning plants were obtained from local sources, 11 percent from towns and cities within the state, and 9 percent from outside the state. The capacity of canning plants in Maryland was estimated at 10,000,000 cases for tomatoes, 7,300,000 cases for corn, 5,600,000 cases for snap beans, and 2,500,000 for peas.

About 63 percent of the employees of canning factories in 1942 were women. The total canning house labor requirement at the peak of the 1943 season was estimated at 30,000.

**Housing Conditions and Facilities for Farm Labor**—About 250 farmers in six major type of farming areas were interviewed for information on farm labor wages, perquisites supplied laborers, housing conditions for farm laborers, and other important labor problems.

Average monthly wages paid permanent farm laborers in 1942 were \$43 in cash and \$20 in value of perquisites, or a total of \$63. Perquisites were supplied 96 percent of the permanent laborers. About 77 percent of the permanent and seasonal farm laborers were housed on the farms. Housing conditions for farm laborers can be described as sub-standard. Most farmers preferred to house their permanent laborers.

Inadequate labor supply was reported by 84.1 percent of the farmers surveyed; lack of experience and ability of laborers, especially in operating machinery, by 43.6 percent; improper attitude of laborers by 36.5 percent; unwillingness to work full time by 32.1 percent; and lack of housing facilities for labor by 23.4 percent of the farmers.

#### FARM TAXATION AND FINANCE

**Improving or Surfacing County Roads**—Gasoline taxes constitute the major income for support of county roads. This revenue has declined rapidly since the United States entered the war. Additional local taxes for county road support may be needed. Such local taxes should not be excessive or unequal, and should supplement the tax earnings from traffic over county roads.

Farm motor vehicles are driven more, proportionately, than other vehicles over county roads. Highway-user taxes from traffic over county roads represent about one-half of the cost of such roads in rural areas. To support these roads solely from

county or election district property taxation would create excessive and unequal tax burdens. The basis for allocating gasoline taxes to counties should be more closely related to needs for, and use of, county roads. State gasoline taxes and local levies should be combined for county road support and a state road equalization fund should be used to prevent excessive local road taxation.

Annual Report of Farm Bureau—Grange Joint Tax Committee—Data assembled and analyzed in this report show that farm property taxes in Maryland decreased an average of 7 percent from 1941 to 1942. This decrease resulted from a drop of one cent in the average county property tax rate and over 9 cents in the state property tax rate.

Net gasoline tax revenues declined one-third in 1942 from 1941. Revenues from the motor vehicle titling tax, traders' licenses, and race tracks declined. Certain state taxes, such as taxes on alcoholic beverages and beer, and income taxes, showed a striking increase in 1942 over 1941. The principal state tax sources of Maryland produced about \$44,250,000 in 1940, \$47,700,000 in 1941, and \$50,250,000 in 1942. This increase has taken place despite the reduction of \$2,000,000 in the state property tax in 1942, made possible because of the increase in other revenues, especially the income tax.

The apparent state general fund surplus was \$8,250,000 in October, 1942, after reserving \$2,000,000 as a state working fund and using \$4,000,000 for reduction of the state property tax in 1942 and 1943. The surplus, in excess of a necessary current reserve, should be utilized in one or more of the following ways:

1. Reduce property taxes.
2. Liquidate debts of the state or other agencies.
3. Set up a trustee fund or reserve fund to finance post-war projects and emergencies.
4. Allocate such funds to local governments, thereby reducing the local property tax.

#### TRANSPORTATION AND MARKETING

**Quality and Price of Canned Vegetables**—Of the three canned vegetables studied—peas, corn, and tomatoes—peas was the only one that showed a significant relationship between retail price and quality. But price alone was not a safe guide as to quality. Prices of cans of the same brand of peas varied from 13 cents to 20 cents per can in different stores. Labels on the cans did not accurately describe contents, which varied widely for the same brands. Out of 108 brands of canned vegetables purchased, only

6 were labeled with complete and correct information regarding quality. Therefore, consumers cannot be certain that quality of canned vegetables is related to price. This is a disadvantage to canners who label cans properly according to contents. Large purchases of canned vegetables are made by the Government for the armed forces, and such products should be delivered according to grade specifications.

Results of this study should encourage producers, consumers, marketing specialists, canners and distributors to develop a quality program for canned vegetables.

**The Broiler Industry in Maryland**—Production of broilers has become a highly specialized phase of the poultry industry in Maryland. It has increased from about 2,000,000 birds in 1934 on the Eastern Shore to 16,000,000 birds in 1941, 18,000,000 in 1942, and 23,000,000 in 1943.

Studies have been made of practically all phases of this important and comparatively new industry, and efforts are in progress to formulate a basis upon which future estimates of the industry may be made.

Marketing methods have been influenced by the introduction of dressing plants. Estimates for 1942 indicate that about 85 percent of Maryland broilers were marketed through dressing plants.

**Farm Prices**—Agriculture is affected by the trend of the general price level. With the strengthened demand and limited civilian supplies incident to war, prices rise rapidly.

Price relationships were studied from the standpoint of "War-time Prices and Agriculture," and "Trends in Wartime Farm Prices in Maryland." These studies show the trend of the general price level and of farm prices; the trend of cost of living; a comparison of prices during World War I and World War II; price control legislation and its influence on farm prices; and trends of farm prices in Maryland during the two World War periods.

Farm prices in Maryland varied from a peak index of 222 in 1920 to a low of 83 in 1933, as compared with 100 during the 1910-14 base period. Cash farm income ranged from a low of about 45 million dollars in 1932 to over 118 million dollars in 1942.

Price is the greatest incentive to increased agricultural production. Farm prices must be kept in line with increasing costs of production if the production of food is to be increased during the war emergency to supply the greatly increased demand. While prices of farm products have increased materially during the war period, the items which enter into cost of production and family living have advanced with increased industrial wages. Either farm prices will have to be increased as costs go up, or

farm prices and all items of farm production and living will have to be adjusted on an equitable basis and maintained at that level.

**Transportation of Farm Products**—Significant information regarding the extent of truck travel in the movement of farm commodities and supplies was obtained from data for 7,332 trucks, taken from field records of the Maryland State Roads Commission. The proportions of truck mileage involved in empty hauls and long-distance hauls indicate the importance of reducing these factors to conserve transportation facilities during the war emergency.

Approximately 24 percent of the trucks hauling commodities and supplies made trips empty. These empty trips averaged 95 miles, and 27 per cent of such trips were less than 26 miles. About 44 percent of the empty trucks were going from market to farm. Loaded trucks averaged 101 miles per trip and 34 percent of the trucks traveled less than 26 miles per trip. About 36 percent of the loaded trucks traveled from farm to market and 38 percent traveled from market to market.

A survey of shippers to the Massey and Sudlersville milk cooling stations indicates that the mileage of commercial trucks could be reduced 6.5 percent if farmers brought their milk to the farm entrance. Elimination of "pick-ups" on unimproved roads would save at least 11.5 percent in mileage. Delivery of empty cans the next morning to farmers not on the main highway, or to central platforms, would reduce travel by about 8 percent.

## MECHANICAL FARM EQUIPMENT

**Sweet Potato Curing and Storing**—One year's work in curing and storing sweet potatoes indicates that electric strip heaters placed under a slatted floor provide the most uniform conditions in the sweet potato house with the least work, but at the highest cost. Except for small, well-insulated houses it is doubtful whether electric heat would be practical this far North. Finned strip heaters used less power than plain strip heaters. It has not been determined whether this is due entirely to the heaters or to possible differences in the two houses. The finned heaters show less rusting, as they operate at lower temperatures.

Hot-water heat in the form of pipe radiators under a slatted floor provided quite uniform conditions, but required more attention when hand operated.

Coal stoves, whether bare or jacketed, produced high ceiling and low floor temperatures. They are harder to control and require more work.

In the small, but tightly-constructed, well-ventilated houses, a slight amount of ventilation was required for only one day of the curing period, and no ventilation was used during the storing



period. High humidities were maintained throughout the storage period without use of humidifiers.

The final results give some idea of the effectiveness of the storage program. Shrinkage was 12.6 percent in one house and 11.5 percent in the other. This includes loss of water from wet baskets and loss of sand in handling. Losses due to rots or spoiled potatoes were 1.1 percent in one house and 2.4 percent in the other after storage from October to March, or four and one-half months. Several baskets of sweet potatoes which were repacked carefully and left in storage were still in excellent condition July 1.

**Egg Coolers and Cooling Conditions**—A mechanical egg cooler was given a rather thorough test under farm conditions near Odenton, Maryland. It was placed in a well-ventilated building similar to a feed room.

Eggs cooled and stored in the cooler at 55° F. dropped one-half grade during the first week and one grade during the first two weeks, whereas similar eggs stored in the farmer's egg cellar dropped one grade during the first week and one and one-half grades during the first two weeks.

Fifteen dozen eggs could be cooled from 95° F. to below 60° F. in one hour in the cooler. One of the big problems was cleaning the eggs. Eggs "sweat" or condense moisture from the air as soon as they are removed from the cooler. Such wet eggs cannot be cleaned satisfactorily. Cleaning eggs at the time they are gathered does not appear practical from the farmer's viewpoint.

The farmer's egg cellar, part of his residence basement, maintained remarkably uniform temperatures, slightly above 70° F., with a relative humidity between 80 and 85 percent.

**Dehydration of Fruits and Vegetables**—Drying time appears to be one of the most important operating factors in determining the quality of dehydrated foods. This requires high air velocity and the highest temperature that will not scorch or damage the material otherwise. For most materials, the permissible temperature is higher at the start of the process, when the material is quite wet, than at the end of the process, when the material is dry. To obtain the low moisture contents required for good keeping of most materials, it is necessary to have the air very dry in the final stages of the drying process. The driest air obtainable, without use of dehumidifiers, is air heated to the desired temperature and passed through the final stage of the drier only once—no recirculation. To increase efficiency, this air should be re-used in the initial drying stages. This requires a multi-stage dehydrator. A laboratory model of this unit has been constructed and used very effectively in determining other important factors in commercial dehydration of several fruits and vegetables.

## FARM CROPS AND SOILS

**Hybrids and Open-Pollinated Corn Compared**—Hybrids have been tested at the Experiment Station that clearly outyield open-pollinated varieties in the average season, except possibly at elevations above 1,500 feet in Western Maryland.

The highest yielding entry in every replicated station test since 1935 has been a hybrid. As a short-season corn, Iowa 939 hybrid shows a superiority of 20 percent over the Lancaster Sure Crop variety. As a medium-season corn, U. S. 13 shows an average superiority of 14 percent over Golden Queen. As a long-season corn, Illinois 448 shows an average superiority of 19 percent over Reid.

Further improvement is expected from breeding and testing work that is in progress.

**New Sweet Corns Give Promise**—Evidence that new sweet corns of increased yield and good quality can be expected has been obtained in the trial plots and in the breeding nursery. A dozen years ago only white varieties gave satisfactory yields in this area. In recent years yellow hybrids of high quality have been produced which yield well and mature earlier than standard white varieties and hybrids.

Trial plantings of some of the newest yellow hybrids show promise of further yield increase without appreciable sacrifice in quality.

Crosses including the Maryland Station inbred line H-84 show marked yield increases among white corns. The progenies of top crosses of this inbred line with commercial varieties or hybrids, when compared with the female parent, show yield increases of 25 percent at College Park and 35 percent at Ridgely as averages of three years.

**Wheat Varieties Recommended**—The safest recommendation still is Leapland for high land, except in the mountain counties, and Mammoth Red for low land of the valleys or Coastal Plain. Because Mammoth Red seed stocks have been scarce in recent years, Nittany acreage has expanded. With increased supplies of Mammoth Red seed in the next few years, Nittany acreage is likely to be reduced. In the Mountain areas, Thorne shows promise, but more needs to be learned about it in other parts of the state.

**Barley Varieties**—The only new variety that may have a place is Wong. It is a beardless, stiff-strawed, small-seeded variety with a high degree of winter hardiness under some conditions. More must be learned about its limitations before it can be recommended. In the meantime, it is safe to stick to Tennessee Winter

and Monobarb. No spring barley has been found that can compare with oats in this area.

**Yellow Varieties of Soybeans Compared with Wilson**—During a number of years the best varieties of yellow soybeans for this area have usually produced seed yields slightly higher than those of Wilson black beans. At the same time, the yellow varieties have tended to show more beans damaged by mold than the black varieties. In five trials during the last three years, Manchu has outyielded Wilson in all of them and Scioto, Illini and Haverlandt have outyielded Wilson in four out of five.

**Pasture for Dairy Herds**—There are high-producing dairy herds in the state that obtain from pasture one-third of their total nutrients for the 12-month period, and it should be possible to increase that proportion without loss of milk.

Kentucky bluegrass remains reasonably productive through only a part of the grazing season. Any unused grass quickly loses palatability so that animals forced to eat it drop in milk production. Different pasture grasses may make their best growth in different seasons of the year. Some remain palatable to later stages of maturity than others. Combinations of pasture plants can be so selected that abundant pasturage, both palatable and nutritious, is available at all times in a normal growing season. When such combinations are worked out, they permit more than one-third of the total nutrients to come from pasture.

**Liming Materials For the Coastal Plain**—Trials show that by-product slag from Baltimore, which can be shipped to the Coastal Plain by water, has distinct possibilities, but tests must be continued. On soils with an initial pH of 4.4 soybean yields were favorable. On wheat following soybeans results from burned lime distinctly overshadowed others. Apparently, nitrification in the cold spring weather was stimulated by the burned lime.

**Nitrogen on Small Grains**—Tests now in progress indicate that at present prices and when properly balanced with minerals, increased quantities of nitrogen on small grains are justified, either in the fall or spring, up to the point where there is danger that the crop will lodge because of weak straw. Spring top-dressings are amply justified whenever the plants fail to start with a vigorous, dark-green spring growth.

With applications of complete mixed fertilizer varying from 300 to 400 pounds per acre on land receiving no manure in the rotation, yields of corn, wheat, barley and rye have been increased by larger amounts of nitrogen up to 6 percent in the fertilizer. In one series of tests, each pound of nitrogen in a 4-12-6 fertilizer produced .54 bushel of corn more than was produced by an 0-12-6 fertilizer, as a three-year average.

In tests of spring top-dressing on fall seeded barley extending over two years on land where yields have been relatively low, each pound of nitrogen applied has produced an average of .72 bushel of barley. The rate of top-dressing in these tests has varied from 21 to 25 pounds of nitrogen per acre in the form of sulphate of ammonia.

Each pound of nitrogen applied in tests of spring top-dressing of wheat extending over three years has produced an average of .30 bushel of wheat, with the range being from .14 to .67 bushel. The rate of application in these tests has varied from 16 pounds of nitrogen in the form of nitrate of soda to 40 pounds in the form of sulphate of ammonia. Lowest responses have resulted when nitrogen in the soil was abundant, or when minerals were deficient.

**Value of Legumes in Small Grain Stubble**—More than 20 years ago, studies at this Station showed that a successful stand of sweet clover in wheat stubble that was plowed in August for a following wheat crop paid well in increased grain yield. Last year a successful stand of lespedeza in the wheat stubble that was plowed for wheat added 10 bushels to a 20-bushel wheat crop and 4 bushels to a 30-bushel crop. The lespedeza seed is cheap and reasonably certain to produce a successful crop.

## BEEF CATTLE, SHEEP, AND HOGS

**Value of Shelled Corn, Crushed Barley and Crushed Wheat, Fed to Steers With Corn Silage and Mixed Legume Hay**—With a view to helping feeders of the state obtain maximum results from feeds commonly used, efforts were continued to secure practical information on the value of such feeds in various combinations.

Four uniform lots of Virginia-bred Hereford steers, 10 steers to the lot, were full-fed in dry lot. The ration for Lot 1 was shelled corn, soybean oil meal, corn silage and mixed legume hay. Lot 2 received corn and crushed barley in the ratio of 1:1, soybean oil meal, corn silage and mixed legume hay. Lot 3 was given corn and crushed wheat in the ratio of 1:1, soybean oil meal, corn silage and mixed hay. And, Lot 4 was fed corn, crushed barley, and crushed wheat in the ratio 1:1:1, soybean oil meal, corn silage and mixed legume hay.

A fifth lot was wintered on a limited amount of corn and cob meal and soybean oil meal, mixed legume hay and corn stover. When on pasture, they were fed a limited grain ration and will be finished in dry-lot on a full feed of grain for 30 to 60 days. These steers were fed so as to gain approximately one pound daily during the wintering period.

Average daily gains per steer showed no significant differences for the first 140 days; the average per steer for Lots 1, 2, 3, and



4 being 1.96, 1.99, 2.09, and 2.04 pounds. At the close of the 140-day period, Lot 3 had made the most efficient gains in relation to the amount of feed consumed, followed in order by Lots 4, 2, and 1.

Hogs following the four lots of steers were fed approximately 40 percent of a full grain ration. The amount of pork produced per steer at the close of the 140-day period was 75.5, 84.7, 81.5, and 82.4 pounds, respectively, for Lots 1, 2, 3, and 4.

**Corn Silage in Winter Rations for Pregnant Ewes**—Results of work this year, and a previous feeding trial, indicate that pregnant ewes may be fed up to 3.5 pounds of silage per 100 pounds live weight daily with satisfactory outcome. The larger use of silage in this manner will reduce cost of the ration and release legume hay for use by other classes of livestock.

Three lots of ewes were fed from November 19, 1942, to April 29, 1943, on the following roughage rations, supplemented with shelled corn and linseed oil meal in sufficient amounts to equalize the amount of digestible protein and total digestible nutrients in the three lots. The roughage consisted of corn silage and U. S. No. 2 clover-light timothy mixed hay. The daily allowances per 100 pounds of live weight were: Lot 1, 3.50 pounds of silage and .87 pounds of hay; Lot 2, 1.75 pounds of silage and 1.75 pounds of hay; Lot 3, 2.63 pounds of hay.

The ewes in Lot 1, the heavy silage-fed lot, gained an average of 16.2 pounds during the lactation period; whereas, the ewes in Lots 2 and 3 lost 6.3 and 14.9 pounds, respectively. At the close of the period, ewes in Lot 1 were in best condition, followed in order by Lots 2 and 3.

There was no difference in the grease weight of the fleeces produced by the several lots, but ewes in Lot 1 produced the longest fleeces.

Lambs in Lot 3 averaged slightly heavier at birth, but lambs in Lot 2 were somewhat heavier at the end of the trial. Average daily gains per lamb for Lots 1, 2, and 3 were, respectively, .58, .62, and .48 of a pound.

Four ewes in Lot 1 died from udder infection and from digestive disturbances. No losses occurred in Lot 2. One ewe in Lot 3 died from hemorrhagic septicemia.

**Salt Penetration in Hams**—Continuation of the work on curing hams, which has been conducted over a period of years in cooperation with the Bureau of Animal Industry of the U. S. Department of Agriculture, resulted in information which may be of practical value. It has been recognized that the usual method of curing is open to objection because of its failure to obtain uniform distribution of the salt throughout the meat. Efforts have been made to find ways to overcome that objection.



FIG. 1. *X-ray of the arterial system of a ham, taken from the face side.*

Study of the Arterial system of hams by means of liquid latex and X-ray photographs showed that the femoral artery, with its branches and tributaries, formed a network extending into the muscular tissues, bone marrow and fat.

Fifty-four commercial hams were given different brine cures,

including immersion, tissue pumping and injection into the femoral artery under gravity pressure and under 10, 20, 30, and 40 pounds pressure.

Hams arterially pumped under 40 pounds pressure retained more brine and showed a higher salt content, which was less variable, than did hams that were tissue pumped at the same pressure.

The gravity system of injection resulted in a lower salt content, but produced as uniform salt distribution as did hams arterially pumped under 40 pounds pressure.

Distribution of salt within the ham, as well as total salt content, did not appear to be affected materially by the pressure when the strength of the brine solution and the proportionate amount injected remained fairly constant.

Groups of hams were cured by a 26.3 percent brine solution, one by immersion, one by arterial injection of 20 percent by weight, and a third by gravity injection. Salt analyses were made after 7, 14, 28 and 42 days in cure. At the end of each time period, the gravity and pressure groups showed a much higher salt content than did the immersion group, and the distribution was more uniform.

Muscles close to the face side usually contained the most salt in hams cured by immersion; those lying close to the bone on the fat side contained the least. The reverse appears to occur in arterially injected hams. Brine forced into the arterial system of hams under controlled pressure may bring about the necessary salt concentration in ham tissues almost at once.

**Swine Breeding Investigations**—Efforts to develop a strain of black hogs combining the most desirable characteristics of the Danish Landrace and Berkshire breeds were continued for the third year. The work is conducted jointly with the Bureau of Animal Industry of the U. S. Department of Agriculture.

Females carrying three-fourths Berkshire and one-fourth Landrace blood were mated this year to a purebred Landrace boar. These cross breds will be inter-mated and from the progeny thus obtained black offspring will be selected. These selected blacks will be mated to a purebred Landrace boar, the resulting offspring being thirteen-sixteenths Landrace and three-sixteenths Berkshire, and white in color. These whites will be mated, black males and black females being selected from among the progeny. By inter-mating these individuals an attempt will be made to fix the black color.

## DISEASES OF ANIMALS

**Bang's Disease — Calfhood Vaccination—**Continued studies show that best results are obtained when calves are vaccinated with Strain 19 between 4 and 8 months of age, since blood reactions do not remain as long as when older animals are treated. Less than 1 percent of vaccinated animals aborted. Infection of udders was present in a small number of vaccinated animals, and all of these infected cows showed positive blood reactions. The germ causing udder infection did not resemble Strain 19, used for vaccination.

Vaccination of mature cows with Strain 19 has not been practiced extensively enough to furnish information of value. The blood reaction in cows in which vaccine was injected into the layers of the skin declined faster than in cows injected beneath the skin with a larger dose.

Since the value of the agglutination blood reaction as an indication of resistance or immunity has been questioned, other blood reactions are being studied.

**Bovine Trichomoniasis—**Where there is a chance that this disease of the genital tract of cattle is present, breeding should be discontinued entirely until it can be shown safe to continue. It cannot always be diagnosed by the herd history and by laboratory examination and repeated studies are often necessary. No satisfactory medicinal treatment has been found.

**Diagnosis of Brucellosis of Swine—**Slight decreases in the red blood corpuscles and hemoglobin appear characteristic of this disease. In agglutination blood tests, low reactions appear significant, being encountered in early and late stages of the disease, with very high titers in the acute stages. Other blood reactions apparently associated with resistance or immunity show highest during recovery.

**Control of Mastitis—**Promising results continued to be secured from chemical treatment combined with sanitary practices. Treatment of cows in milk showed an average efficiency of about 50 percent, whereas treatment of cows during the dry period showed about 70 percent. The dry cow treatment is only completely satisfactory when it is possible to prevent reinfection of the clean cows from untreated animals, or those not cured completely.

## PLANTS AND THEIR DISEASES

Practically all that was attempted in a number of lines of investigation which were designed originally to obtain basic information regarding plants, their improvement and control of certain problems connected with their growth, was to maintain



the material and progress developed in former years. It was the aim to retain the valuable work of past years in such manner that the investigations could be carried forward when conditions permit.

**Potato Diseases**—Two seedling potatoes have been developed which it is believed can be produced more profitably by many growers than the varieties they are now growing. Plans are being made to name and introduce these varieties as soon as enough seed stock is available. One of them matures early and the other matures late.

The early-maturing variety (seedling 47148) significantly outyielded the Irish Cobbler variety at Pocomoke in 1942. In spite of the fact that practically no rain fell during the entire growing season, it yielded 187 bushels per acre of U. S. No. 1 potatoes, compared with 120 bushels per acre of U. S. No. 1 potatoes by Irish Cobbler. The tubers were smoother and the proportion of large tubers was greater. Planted as a late crop at Pocomoke in 1942, it yielded 160 bushels per acre of U. S. No. 1 potatoes, compared with 119 bushels per acre from the standard Dakota Red variety.

The late-maturing variety (seedling B247) has outyielded the standard smooth rural variety for six consecutive years. Although the Sequoia variety has consistently outyielded seedling B247, it is not safe to grow unless it can be sprayed very thoroughly, since the tubers are extremely susceptible to late blight. In 1941 and 1942, seedling B247 outyielded the smooth rural variety in an unsprayed plot where late blight and injury from flea beetles and leaf hoppers were very severe. It also outyielded the standard Dakota Red variety when planted for a late crop at lower elevations.

In comparative spraying tests in Garrett County a yellow copper oxide spray known as 54y gave almost as good results in control of late blight as Bordeaux mixture, 4-4-50.

**Cantaloupes**—While no cultural practices were found which would absolutely control fusarium wilt of cantaloupes, the disease was less severe when the available potash was high with respect to available nitrate. In other words, fusarium wilt was held at a lower level when the crop was fertilized with 4-8-16 or 4-8-20 than when the usual 6-6-5 fertilizer was used. Dolomitic limestone in combination with high potash further reduced wilt.

Further investigation of the effect of the wilt fungus on susceptible cantaloupes and on cucumbers has shown that the fungus invades the tissues of cucumbers and of resistant cantaloupes as well as of susceptible cantaloupes. This shows that isolation

of the pathogen from a plant is not a criterion of its susceptibility to wilt and that in the development of wilt-resistant varieties of cantaloupes greenhouse indexing, in the seedling stage, should not be depended upon to give an accurate picture of the probable performance of plants under field conditions.

**Strawberry Disease**—A large number of new strawberry hybrids, furnished by the U. S. Department of Agriculture, were tested for resistance to the red stele disease. Most of these tests were on the Eastern Shore in naturally infested soil. By use of new techniques, more than 3,000 hybrids were tested for resistance in the greenhouse. This artificial method of testing for resistance appears to give more uniform results than field testing.

A new red stele resistant variety was named this year as a result of this breeding program. The name given it was "Temple," in honor of Professor C. E. Temple, who began the breeding program in 1938. The new variety has been tested only on the Eastern Shore, but should do well in many parts of the country. It is an excellent mid-season commercial berry of very high quality.

## DAIRY CATTLE AND DAIRY PRODUCTS

**Kelp Meal in Dairy Rations**—Addition of Kelp meal to normal rations for dairy heifers and cows appeared of no particular value for growth, breeding efficiency, health, physical condition, size of calves at birth, or milk production under conditions of an experiment completed.

Thirty-nine pairs of heifers and 25 pairs of cows were used in the test. With the exception that one animal in each pair received the grain mixture containing 4 percent of kelp meal, both groups were fed and managed in exactly the same manner.

Heifers completing their first gestation period showed no advantage in favor of either ration.

Twenty-five pairs of animals were continued on through a second gestation period. Feed consumption and production records were kept on each animal. No differences were noted in the physical condition of cows at calving, nor in the calves born to cows from either ration. Feed consumption records showed no stimulating effect from feeding kelp and live-weight changes were slightly in favor of the kelp-fed animals during lactation.

**Dry Starters for Dairy Calves**—Present demands for milk make it imperative for dairymen to use a minimum of whole milk in raising their calves. The experience of many dairymen

and results of feeding experiments have indicated that thrifty calves of good size, with large body capacity, can be developed with the dry-starter method of feeding.

Some of the ingredients used in the dry starter have become difficult to obtain in the present emergency, and a new formula has been devised, using ingredients more readily available. In the present mixture, crimped oats replaces rolled oats, dried whey replaces dried skim milk, and soybean oil meal replaces corn gluten feed and corn oil meal. The cod-liver oil has been removed and alfalfa leaf meal and irradiated yeast have been added.

A feeding trial is in progress comparing the newly devised starter with the regular formula. One lot of calves receives the old formula, a second lot receives the new formula, and a third lot receives the new mixture with part of the ingredients in pellet form.

Thirty-six calves have been raised to 16 weeks of age to date. Eleven were raised on the old formula, 12 on the new formula, and 13 on the pellet mixture. The calves in all three groups have made satisfactory growth. Gains so far are slightly in favor of the regular formula, or the pre-war mixture; however, the differences are not enough to be significant. There are several calves left in each group to complete the trial before definite conclusions may be drawn.

**Vitamin A and Carotene Requirements of Calves**—Further observations on the effect of colostrum intake on the level of blood plasma vitamin A and carotene indicate the importance to the calf of receiving the first milk. The colostrum contains up to 100 times as much vitamin A as normal milk. Therefore, the intake of colostrum gives the calf a chance to build up considerable reserve of vitamin A in the liver.

If the calf does not receive the colostrum, that reserve is not built up and may have considerable effect upon the health of the calf during the first few months of its life. In several calves that did not receive colostrum, but were started on whole milk, the blood plasma vitamin A content remained at a low level in contrast to those which received the colostrum. Two out of three calves which received no colostrum died. Calves left with the cow for 12 hours did not develop maximum plasma vitamin A values, compared with 72 hours. Those left 24 hours had values almost as high as for the 72-hour period.

Vitamin A requirements of Holstein and Ayrshire calves from 3 to 14 months of age for the winter season have been established. An intake of 66 micrograms of carotene per kilogram of body weight during the winter months is enough to prevent an increase of cerebrospinal fluid pressure in Holstein and Ayr-

shire calves. On a practical basis, each calf should receive one pound of hay of good quality in order to receive a sufficient vitamin A intake. If the hay is of poor quality, a larger allowance should be fed. Preliminary data indicate that the carotene from a poor grade of hay is utilized as well as the carotene from dehydrated alfalfa leaf meal.

Work is in progress to establish the requirements for summer environment.

**Determining Vitamin A Deficiency**—Efforts to find a means for diagnosing vitamin A deficiency in the field have shown that it could be diagnosed by the use of an ophthalmoscope in an examination of the nerve head of the eye in young animals. However, older animals often do not develop the characteristic changes of the nerve head, even when deficient in vitamin A.

Data collected from a considerable number of animals during the last year show that the reason they do not always show the characteristic changes is because of a high intra-ocular tension. Therefore, when diagnosing vitamin A deficiency with an ophthalmoscope, characteristic changes on the nerve head caused by such deficiency may not always be present. It is necessary then to rely on changes in the retina and other clinical symptoms for proper diagnosis.

**Effect of Vitamin A Deficiency on the Central Nervous System**—Calves born to cows fed rations deficient in vitamin A are generally blind, partially paralyzed, and show symptoms indicating alterations of the central nervous system. One calf showing these characteristics came to autopsy during the past year. A study of the spinal cord showed myelin degeneration of some of the nerve tracts. This emphasizes the importance of feeding plenty of good quality hay and other feeds naturally rich in carotene to cows if the calves are to be healthy and strong at birth.

**Effect of Conditions of Storage on Vitamin Content of Spray Dried Whole Milk Powder**—Samples of dried whole milk powder have been packaged in nitrogen and stored at 20°, 30° and 37° C. to determine the effect of temperature and time of storage upon vitamin A, carotene and riboflavin content. The samples are analyzed when placed in storage and will be analyzed after 3, 6, 9, and 12 months.

A satisfactory method was devised for extraction of the fat before making the analyses.

Samples analyzed after six months in storage show 5 to 10 percent decrease in vitamin A and carotene due to length of storage, and an additional 3 to 5 percent decrease when stored



at 37° as compared with 20°. Samples held at 20° showed practically no decrease in riboflavin, and those held at higher temperatures showed only a slight decrease.

**Vitamin Potency of Butter**—The Maryland Experiment Station is cooperating in a national project to determine the vitamin potency of butter. Since this state is not one of the leading butter manufacturing states, tests for vitamin A and carotene are being made at bi-monthly intervals on renovated or process butter to determine season variation.

Tests made in May and July gave 5.13 and 4.18 micrograms of vitamin A per gram of fat, respectively, and 6.74 and 7.35 micrograms of carotene per gram of fat, respectively. The tests will be made for one year, or longer.

## THE FIGHT TO CONTROL INSECTS

**The Pea Aphid**—Annual treatments of either derris sprays or dusts gave satisfactory returns every year tested in a five-year program on pea aphid. Nicotine sprays applied under an apron were highly effective. Greatest returns from derris treatments were obtained in seasons with adequate rainfall. In dry seasons, derris was not as good as nicotine for pea aphid control.

**Corn Ear Worm**—Dusts of commercial cryolite at 15 pounds per acre, or commercial cryolite with 20% sulphur at 20 to 25 pounds per acre, gave practical control of ear worm larvae on string and lima beans. One application to string beans just before podding is sufficient, while two or three applications are necessary to protect lima beans.

**Japanese Beetle**—The cost of present trap baits for Japanese beetles can be reduced 40 to 50 percent by diluting geraniol and eugenol with a mineral oil which has the same evaporating rate as the geraniol and eugenol mixture. Experimental work on the Japanese beetle was confined primarily to improving trap baits.

**Insect Hibernation**—It appears from an investigation on the relation of early spring temperatures to the time aphid populations occur on peas that accurate prediction of spraying date can be made on a basis of late March and early April temperatures.



FIG. 2. *European Corn Borer attacks young corn while still in the "curl." Later the stalk and ear may be injured badly.*

**European Corn Borer**—Severe infestations of this insect occurred in the Carroll, Baltimore, and Harford County area on early sweet corn. Tests with pyrethrum and cube dusts did not give favorable results.

**Concentrated Sprays**—Field experiments using derris and pyrethrum extracts in water gave encouraging results on both pea aphid and Mexican bean beetle. Much careful work is needed, however, before recommendations can be made to growers.

**Migratory Beekeeping**—Results during the first two years

have been very satisfactory. Not only have greatly increased crops of honey been secured, but colonies became more vigorous when kept in favorable localities the entire summer.

## FRUIT AND VEGETABLE CROPS

**Dehydration of Sweet Potatoes—A New Industry in Maryland**—Experimental work on dehydration of this crop was started in 1942 in order to obtain information for commercial dehydra-



FIG. 3. *A small power duster which has been found satisfactory for use on experimental plots. It is equipped with an apron when used for dusting peas.*

tors supplying foods for the Army and Lend-Lease. The importance of this new industry cannot be over-emphasized, as Maryland dehydrators will use from 4,000 to 7,000 tons of sweet potatoes during the 1943-1944 season.

Problems which received most attention during the past year were: Determination of the most suitable temperatures for the primary and conditioning stages of drying; differential drying ratios and rates of various varieties; effect of curing and storage on the quality and carotene content of the dried product; and the quality of the dried product as measured by reconstitution

and organopeptic tests. Actual drying was done in a two-stage central exhaust pilot tunnel developed by the Department of Agricultural Engineering.

It was found that an initial temperature of 200° to 220° F. in the primary end with 1,200 linear feet of air per minute for



FIG. 4. *An experimental electric cabinet type dehydrator. This machine was used to obtain basic information on drying curves, drying ratios, and in variety studies. Basic information obtained from this machine was used in design of the "pilot" tunnel dehydrator.*

two and one-half or three hours with an additional two to three hours in the conditioning end at 160° F. gave the largest output of high-quality product.

**Drying at Different Intervals Out of Storage**—Uncured potatoes require a longer drying time than cured stock. The uncured do not have the quality of those cured and stored. There was a gradual increase in length of time required to dry the potatoes between those in storage 7 and 13 weeks, but a gradual decrease was noted toward the end of the storage season. Roots kept in storage longest produced the best quality product.

**Varieties for Drying**—Six varieties which were cured and stored under the same conditions were dehydrated for comparisons on drying ratios and quality of dried product. Porto Rico and Nancy Hall gave a narrower drying ratio than the dry-fleshed



Maryland Golden or Big Stem Jersey. However, the drying ratio is not the only important consideration in determining output in any given time. The length of time required to dry a variety to a certain moisture content is also important, and

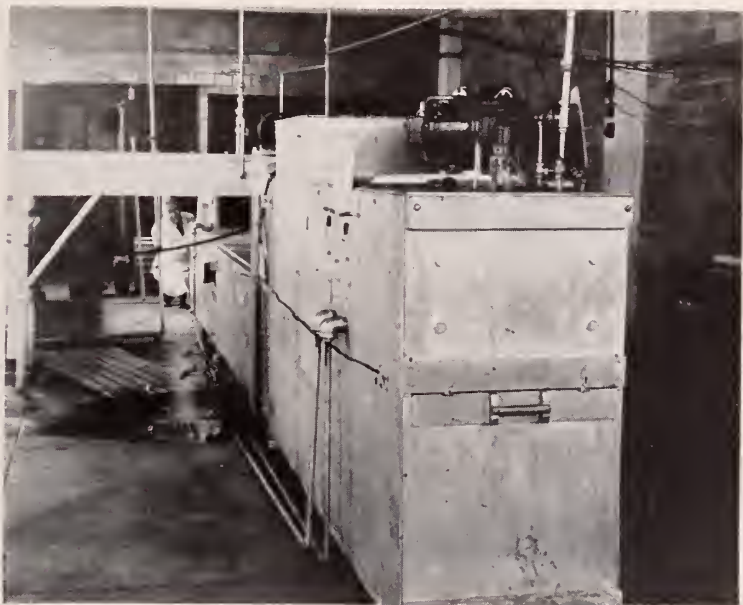


FIG. 5. *Experimental two-stage central exhaust tunnel dehydrator. Air velocity in the primary end can be varied from 200 to 1,400 linear feet of air per minute, and the temperature from 120 to 270 degrees. F. The air velocity in the conditioning end can be varied from 120 to 200 feet of air per minute, and the temperatures from 80 to 200 degrees F.*

Maryland Golden required about 33 percent less time to dry down to a standard moisture content than Porto Rico.

Reconstruction, or rehydration, of dried samples of the various varieties showed some very interesting differences. Maryland Golden and Orange Little Stem had about the same ability to reabsorb water, and Big Stem Jersey, the parent variety, was only slightly lower. The most important fact about these tests was the extremely low rehydration ability of Porto Rico. Reconstituted Maryland Golden weighed  $29\frac{1}{2}$  percent more than Porto Rico.

**Carotene, or Pro-Vitamin-A, Changes as a Result of Dehydration**—There was no significant loss of carotene as a result of de-

hydration and storage for two months in sealed vapor-proof containers. No appreciable change in the carotene content took place as a result of reconstitution in boiling water, nor in cooking.

The most important fact brought out is the extremely high carotene content of Maryland Golden. It is far superior to any other variety as a source of pro-vitamin-A. Orange Little Stem and Nancy Gold, two new varieties especially selected for higher carotene content by the Kansas Station, while much superior to their parent varieties, are still not comparable to Maryland Golden grown under the same conditions. Maryland Golden had almost three times the carotene content of Porto Rico, when both were grown in this state.

Complete details of this work are published in Miscellaneous Publication No. 18 of this Station.

**Dehydration of Peas, Sweet Corn, and Lima Beans—Peas.**—Alaska and Thomas Laxton peas were harvested as for canning and were subjected to various blanching treatments, sulphiting to prevent loss of color, and various drying temperatures. Losses of ascorbic acid, due to various blanching and drying treatments were determined.

Steam blanching was more effective than the hot water blanch in the inactivation of peroxidase. Four minutes in steam at 214° was superior to six minutes in boiling water. A 30-second dip in a 0.2 percent sodium sulphite solution was very effective in fixing color. Higher temperatures in the primary end (170°-180°) produced a better product than temperatures of 140° or 150°.

It was found that the quality of dehydrated peas was definitely inferior to samples canned from the same lots. This was due primarily to toughness of the seed coat and even of the cotyledons. This can be eliminated partially by cooking in a pressure cooker, but some flavor is lost in the process. Therefore, as long as tin cans are available, a better quality product can be obtained from canning than by dehydration.

**Sweet Corn.**—Sweet Corn was harvested at several stages of maturity, blanched on and off the cob, both in steam and hot water, and dried at various temperatures. It was found that a very satisfactory product could be produced by cutting tender corn off the cob, blanching for 5 minutes in steam at 215° F., and drying at 170° F. in the primary stage and 160° F. in the finishing stage in the experimental tunnels. The final moisture content should be about 8 percent, as corn of lower moisture content does not reconstitute well and corn of a higher moisture content does not keep well.

**Green Lima Beans.**—Preliminary work on drying Henderson and Early Baby Potato limas in the green shell stage was started this year, and more will be done the coming season.

Although the beans split open upon curing and were not very attractive, they reconstituted satisfactorily and closely approached fresh beans in appearance.

**Dehydration of Maryland Apple Varieties**—Timely work on dehydration of apples was started in 1942, and will be continued as long as problems exist of interest to the industry and the war effort. With a considerable expansion of the dehydrated apple industry needed to meet Army, Navy, and Lend-Lease requirements, the apple processors started dehydrating apples from the Cumberland-Shenandoah region, using newly constructed tunnel dryers. Part of the 1942 canning stock was dehydrated after the allotment of tin cans was used up in January, 1943.

Questions of variety suitability, storage behavior of the dehydrated product, and conditions necessary for quality production appeared to be of first importance as an aid to the industry. With the use of a pilot two-stage tunnel, apple varieties of Maryland, including Grimes Golden, Stayman Winesap, Rome, and York Imperial were found to make excellent dehydrated segments, with good yields from well matured fruits, 2½ inches and up in size. Jonathan made a good product, but the yield was relatively low. Ben Davis was not of good quality, except for color, and made very poor pie stock. Dehydrated Stayman was excellent, and York was a close second for pie stock.

In storage studies of the dehydrated product in No. 1 tin cans, hermetically sealed and held at temperatures of 32° F., 110° F., and ordinary room temperatures of 70° to 90° F., it was found that at the high temperature (110°) the dehydrated apple segments or rings turned brown in 8 days and had a hay-like odor. At 70° to 90° F., the color of the fruit changed noticeably in 6 months, but retained good quality. At 32° F., no change in color or quality was detected, although there was some loss of vitamin C. Loss of that vitamin was very pronounced at the high storage temperature.

It was shown clearly that both high temperatures (190° and 200°) and high humidity during the first half of the drying period caused a marked decrease in quality of the dehydrated product, as measured by color, reconstitution rate, and vitamin C content. Best results were secured with a temperature of 175° F. during the initial half of the drying period, followed by 165° F. in the final period, together with maintenance of low humidity and high air velocity (1,200 feet per minute in the primary tunnel). Such drying conditions brought apple segments (16 per apple) down to 12 to 18 percent moisture in 4½ hours, and the resulting product was excellent in appearance, made good apple sauce and pies, practically indistinguishable from those made from fresh apples. Also, there was only 20

percent loss of vitamin C, compared to 80 percent loss under higher temperature and humidity conditions.

**Buds of Peach Varieties Differ in Resistance to Winter Injury**—Severe injury to peach buds during the past winter (1942-43), particularly on the Eastern Shore and in the central sections of Maryland, revives interest of growers in the comparative resistance of peach varieties to low winter temperatures.

Forty-three varieties, growing in a block on a uniform and relatively level area at the Maryland Plant Research Farm, afforded an excellent comparison of variety resistance to the sub-zero temperatures which prevailed, the lowest point being recorded on the night of December 21, 1942. The following table groups results of observations on April 5, 1943:

90-100 Percent Killed	60-90 Percent Killed	20-60 Percent Killed	Less Than 20 Percent Killed
O'Boy	Halate	Raritan Rose	
Mikado	Rio Oso Gem	Veteran	Golden Jubilee
Corvallis	Elberta	July Elberta	Cumberland
Tena	Hardy Elberta	Hardee	Calora
Shipper's Late	Vedette	Valiant	Frank
Sunhigh	Leona	Salway	Lizzie
Pacemaker	Summercrest	Goldeneast	
Kalhaven	Afterglow	White Hale	
Golden Globe	Red Elberta	Early Elberta	
		Halehaven	
		New Day	
		Fisher	
		Triogen	
		Red Bird	
		Maryland 1-15	
		Frankie	
		Barbara	
		Salberta	
		Best May	

**New Cultural Practice Insures Good Strawberry Yields**—Work by the Maryland Station on the Eastern Shore and at College Park during several seasons has shown the extreme value of strawberry plant thinning (also called spacing) in increasing the yields of Blakemore over the customary matted row method of culture. More recently it was found that increased yields could be obtained by this practice if the width of row was restricted to about 10 inches with a planting distance of two feet between rows. The increased yield is probably due to the use of early runner plants, which form rows 24 to 30 inches in width and in some seasons do not have sufficient stand to fill the width of row. Even in the most favorable season for fruiting



of the wider row, with a full stand of thinned plants, the narrow row had an equal yield of fruit in spite of much fewer plants per acre.

Although some growers have adopted the plant thinning practice, it is recommended that a narrower thinned row be used with Blakemore under Maryland conditions, and that the width of row be as narrow as 10 inches.

A new method of renewal, in addition to the thinning practice, will give a further increase in yield the second fruiting year. In this method the thinned plants after the first season of fruiting are maintained in place, but all runner plants are removed during the season. The yield the second year has been found nearly equal to that of the first season, instead of the usual half-crop on varieties such as Blakemore.

**Causes of Abnormal Growth and Fruiting Behavior of Peach Trees**—Of particular important to peach growers is the finding that no positive evidence has been disclosed that any of the new virus diseases, such as the so-called "X-disease" has as yet attained a foothold. A few individual trees have been found which have shown symptoms that conceivably might be of a virus character. Buds have been taken from these trees and inserted into healthy seedling stocks to determine whether the symptoms would prove transmissible.

Most of the causal factors for tree failures have been found to be cultural, or due to improper orchard management. Some of the more important of these cultural conditions responsible for poor growth or complete loss of tree are: Failure to obtain borer control, usually due to lack of timeliness or method of making control applications; over-deep planting, especially on sites with heavy or impervious sub-soils, or on terraces; poor drainage; planting on badly eroded sites, or on shallow soils caused by improper terracing; inadequate fertilization on poor or shallow soils; improper cover crop management, particularly as related to soil moisture conditions or drought periods; close planting, which with older trees is often associated with inadequate moisture and malnutrition; and failure to control damage from mice.

Efforts to find the most practical ways by which growers can take remedial measures are being sought cooperatively by the Department of Horticulture, Plant Pathology, Soils, and Entomology.

**Tomato Variety Test**—Rutgers yielded 16 percent more marketable tomatoes than Marglobe, and 27 percent more than the new Pan America in a variety trial at College Park in 1942. One selection from the Maryland Experiment Station of a cross

of Marglobe and Brown's Special yielded slightly higher than Rutgers. This tomato needs further selection for type and back-crossing for wilt resistance. Its principal advantage is its relative freedom from serious cracking.

The most interesting result of the trial was the performance of Pan America. Its low yield compared with Rutgers and Marglobe bears out observations of the previous year. Great hopes were held for this variety because of its high resistance to Fusarium wilt. On the basis of its performance this year, it seems that it should not be used for the canning crop except on wilt-infested soil.

The picking season for Pan America was very similar to Marglobe, although it came to a slightly earlier peak and dropped off more rapidly. Rutgers had a more uniform spread of season than either Pan America or Marglobe, building up to and tapering off from the peak gradually. The Marglobe x Brown's Special selection was about a week later in reaching the peak than the other varieties and dropped off sharply.

**Tomato Fertilizer Placement**—Various methods of application were compared with the common practice of drilling fertilizer before planting. The standard treatment was 1,000 pounds per acre of a 5-10-5 fertilizer. The plots were on a sandy loam soil of moderate fertility at Ridgely and a fertile clay loam at College Park.

The lowest yield resulted from broadcasting and disking the fertilizer into the soil. It was tried at Ridgely only. The yield was 26 percent below that of the drilled application. Drilling the fertilizer on the surface and plowing under in preparation of the land resulted in a 15 percent increase at Ridgely and a 9 percent increase at College Park over the drilled application. By applying the fertilizer in a single band in the bottom of the furrow, the yield was increased 32 percent at Ridgely and 16 percent at College Park over the drilled application. Application of the fertilizer in two bands five inches from the plants and four inches deep resulted in increases of 33 percent at Ridgely and 27 percent at College Park.

In the "plow under" method, increasing the fertilizer from 500 pounds to 1,000 pounds per acre gave increases in yield of 15 percent at Ridgely and 13 percent at College Park. Increasing the fertilizer from 1,000 to 1,500 pounds gave increases of 27 percent at Ridgely and 6 percent at College Park. Yield increases, due to both rate and method of application, were greater on the light soil at Ridgely than on the heavy, fertile soil at College Park. An increase in the potash from 5 percent to 10 percent in the 1,000 pounds per acre "plow under" application at Ridgely gave an increase in yield of 27 percent.

**Fertilizer Placement for Peas**—Plowing under fertilizer, or applying it in bands in the bottom of the furrow failed to show increases in yield as compared with the usual method of drilling the fertilizer in tests with canning peas at the Ridgely Substation in 1943. The weather was dry and hot and aphid infestation became quite severe a couple of weeks prior to harvest. These conditions may have influenced the results.

The general conclusion drawn from previous tests is that the closer the fertilizer is placed to the seed the better, provided it is not actually in contact with the seed. Placement of the fertilizer in bands  $1\frac{1}{2}$  inches to the side and 1 inch below the seed has given the highest yields of any method of application tried.

**Soybean Experiments**—Work with varieties of edible soybeans was transferred from College Park to the Sub-Station Farm at Ridgely and considerably expanded.

Three plantings of eight varieties were made on May 20, June 12, and July 6. The planting on June 12 was a complete failure, due to dry weather. In the first planting, yields per acre for the varieties were: Emperor, 4,218 lbs.; Bansei, 3,754 lbs.; Imperial, 3,484 lbs.; Higan, 3,273 lbs.; Jogun, 3,168 lbs.; Willomi, 2,626 lbs.; Giant Green, 2,189 lbs.; and Toku, 1,150 lbs. From the July 6 planting the yields were: Higan, 2,987 lbs.; Imperial, 2,445 lbs.; Willomi, 2,113 lbs.; Emperor, 1,618 lbs.; Jogun, 1,521 lbs.; Giant Green, 1,519 lbs.; Bansei, 1,436 lbs.; and Toku, 616 lbs.

Yields in the later planting were much lower, although the beans reached harvest stage well ahead of frost. The number of days from planting to harvest was on the average 25 days less in the later planting than in the first. This indicates that the crop might follow an early crop, such as peas, except in the mountain regions.

Drilled plots planted on July 6 gave a larger yield per acre than row plots. There was well distributed, adequate rainfall after that date and since yield is largely a question of moisture available, it will be necessary to secure data in several seasons before the drilled method can be recommended.

Beans that were processed for canning at 240° F. for 40 minutes gave a better product than samples processed at 250° F. for 20 minutes.

Soybeans may be hulled in a pea viner. The pea screens are used and the first section of the screens, i. e., near the feeding end of the viner, are closed by sheets of plywood, fastened to the inside of the screens by screws. The optimum speed at which the viner is operated will vary for different varieties, but, in general, should be greater than for shelling peas or lima beans.



FIG. 6. Sage field showing stems lying on ground after cutting.

**Growing and Harvesting Sage**—Interest in growing various herbs and condiment plants has increased, coincident with the decline of importations from European countries. Since sage plants have been grown in old gardens for a number of years, it was selected as a crop which would grow well in this region and work was started in 1941 to obtain information regarding its culture and harvesting.

From the tests made and records obtained thus far, it may be stated that sage is not a difficult crop to grow and cure. It can be propagated successfully from seed or cuttings. It will be necessary to continue the fertilizer experiments over a reasonable number of years to determine the kinds and quantities needed.

The expensive and tedious operation in handling the crop is harvesting. This can be done in two ways, both of which involve a large amount of hand labor. The most rapid method of obtaining detached leaves is by stripping them from the stems of the plant by hand and subsequently drying them. Another method is to cut the stems off about 6 to 8 inches above the ground and strip the leaves from the detached stems. The cutting may be done with a mowing machine and the stems raked in bunches and hauled to a stripping shed. This method has the advantage of preventing the plants from becoming too woody.

Since farm labor is critically scarce at this time, harvesting presents the greatest problem in growing this crop extensively.



## POULTRY

**Soybean Meal in Poultry Rations**—The serious shortage of animal protein feedstuffs, including milk products, meat scraps, and fish meal, resulted in extensive use of soybean meal as a source of protein in diets for growing chicks and laying hens. An investigation was made to determine the ability of various materials to supplement a starting and growing mash containing soybean oil meal as the only protein supplement. Also, tests were made of a laying mash containing soybean oil meal and corn gluten meal as the only protein supplements.

Broilers were grown satisfactorily on mashes containing the following combinations of protein supplements: 25% soybean meal and 4% fish meal; 25% soybean oil meal and 4% dried skimmilk; 15% soybean oil meal and 15% corn gluten meal. Combinations of soybean oil meal with meat scrap were not satisfactory except in the case of a special meat scrap containing a large proportion of intestinal linings. Other materials that did not effectively supplement high soybean oil meal diets were: Blood meal, dried fish viscera, powdered swine hoofs, soybean lecithin, NaCl, and KI. A laying mash containing soybean oil meal and corn gluten meal as the only protein supplements supported excellent production and maintained body weight throughout a 7-months' experiment.

**Variation in Feeding Value of Soybean Oil Meals**—Since soybean oil meal has been relied upon so extensively as a source of protein for poultry feeding, an effort was made to determine the effects of different methods of processing meals on their feeding value.

The best meals found were expeller meals, but variability of expeller meals was as great as among solvent meals. The menhaden meal supplement reduces variability, and with nearly all soybean meals results in satisfactory growth. On the basis of heating experiments, it appears unlikely that differences in processing temperatures or time of heating are major causes of variability. Whole soybeans, properly heated in a grain dryer by the Department of Agricultural Engineering, supported good, but not optimum, growth.

**Effect of Nutrition on Hatchability**—That deficiency of riboflavin in an ordinary low-cost laying mash results in a decrease in hatchability was indicated by results of preliminary experiments. Further work showed that synthetic riboflavin added to the basal diet used in these studies at a level of 4.5 mg. per kg. maintained hatchability during a period of 15 months at a level comparable with that of a positive control group which received 5% of dried skimmilk. In a 6-months' trial, 1 mg. of synthetic

riboflavin per kg. of diet maintained hatchability comparable with that of the positive control group. Other materials were tried as supplements to the basal diet and the following were of no value: calcium pantothenate, pyridoxine, choline, nicotinic acid, p-amino benzoic acid, and irradiated water extract of yeast.

**Feeding Value of By-Products in Manufacture of Industrial Alcohol**—Residue remaining from the acetone-butyl alcohol fermentation of molasses had proved an excellent riboflavin supplement for a high soybean oil meal mash of the type now in general use. When shortage of molasses made it necessary to change to grains as raw material for fermentation, the new by-product was investigated. It proved very satisfactory as a riboflavin supplement to the type of mash mentioned above.

**Sources of Riboflavin in Chick Diets**—Dried whey, distillers' solubles, a butyl fermentation residue, synthetic riboflavin, and a riboflavin concentrate mixture were tested as supplements to a chick diet similar to that used in the experiments on butyl fermentation residue mentioned above. Each material was fed to different groups to supply 50, 150, and 250 micrograms per 100 grams of diet. As measured by growth, all supplements were satisfactory sources of riboflavin. The differences obtained were of doubtful significance and so small as to be of no practical importance in view of the present shortage of riboflavin supplements.

**Response of Turkey Poults and Chicks to Different Forms of Vitamin D**—Samples of cod-liver oil, irradiated 7-dehydro-cholesterol, and irradiated animal provitamin were evaluated in comparison with the Standard Reference Cod Liver Oil by two commercial laboratories, using chicks, and by the Station laboratory using turkey poults. The results indicate that vitamin D potencies established by chick assays are probably applicable to turkey feeding practice in case of unfortified cod-liver oils, but are not applicable in the case of materials containing irradiated 7-dehydro-cholesterol or "D-activated animal sterol," the latter two materials having greater potency for turkeys than would be indicated by a chick assay.

**Hatchability of Chicken and Turkey Eggs in Relation to Specific Gravity**—The relationship between specific gravity of 3,330 chicken and 1,559 turkey eggs and their hatchability was studied. Apparently, when the breeding stock has been selected on the basis of high hatchability, there is no relationship between the hatchability and specific gravity of turkey or chicken eggs, whether considered on an individual hen basis, as a family, or as a whole. When breeding stock of chickens has not been

selected on the basis of high hatchability, the results suggest that specific gravity and potential hatchability of fertile eggs are closely related.

When incubated at a wet-bulb temperature of 86°, turkey eggs with a specific gravity of 1.070 or less and 1.095 or more failed to hatch. The percentage hatchability of turkey eggs which had a chalk-white shell was very low. No outstanding differences were noted between medium and dark specked turkey eggs. The optimum incubator humidity for Barred Plymouth Rock and crossbred hatching eggs appears to be 2-3 degrees (wet bulb thermometer) less than the humidity requirements of New Hampshire hatching eggs.

#### **Price Relationship Between Drawn and "Cut-up" Chicken—**

One group of 28 males and 19 females, mostly crossbreds from B. P. Rock male x N. H. females, and another group of 50 crossbred males from similar matings were studied with respect to dressed and drawn percentages of live weight and the percentage of the different parts of cut-up chicken of the chilled, dressed and eviscerated weights, respectively.

Fresh dressed weight is approximately 90 percent of live weight; chilled dressed weight is approximately 88 percent of live weight; eviscerated weight is about 68 to 70 percent of live weight. Gross returns per pound of chicken when sold in cut-up form is determined largely by the price of the breast and legs in relation to other parts and whether the humeri sections of the wing are sold with the breast.

The breast constitutes approximately 20 and 26 percent, respectively, and the legs approximately 26 and 32 percent, respectively, of the chilled dressed and eviscerated weights of 3-pound birds. For 2-pound birds, the comparable percentages are 18, 25, 23.5, and 33.

In another investigation with two groups of 10 new Hampshire cockerels differing in shank length, it was found that the breast, humeri sections of wings, and the legs contribute approximately 38 percent of the chilled dressed weight and about 70 percent of the total edible meat in 3-pound live birds.

**Cooling Eggs Under Farm Conditions—**The effects on egg quality of cooling eggs in an egg cooler under farm conditions were tested in cooperation with the Agricultural Engineering Department. Eggs stored in the cooler graded U. S. Extra after one week, as compared with U. S. Standard for eggs stored in the egg cellar for the same period. It would appear from results obtained thus far that this type egg cooler would maintain high egg quality and reduce the number of trips to market. Some difficulty was experienced in cleaning eggs after they had been

stored in the cooler, due to condensation when the eggs were removed.

**Breeding Chickens for Efficiency in Utilization of Feed**—In order to determine the influence of body type in relation to shank length on efficiency of chickens in utilizing feed for meat and egg production, a long-time breeding project was started to develop strains differing in this factor. The major observation made on the first year's work was the great variability in rate of growth of birds within a family, as well as differences in rates of growth during the first 10 weeks of birds belonging to different families.

**Breeding Chickens for Resistance to Pullorum Disease**—With a view to increasing inherited resistance to bacterium pullorum, this breeding project with Rhode Island Reds was continued for the ninth year. Results indicated greater resistance in 1942 than in 1940 and 1941, and there was an improvement in egg production. During 1943 tests were made on the effects of chilling chicks immediately after hatching. It appears that a long chill at a higher temperature (6 hours at 66° F.) is more effective in producing measurable damage than is a short, intense chill (15 to 60 minutes at 52° F.).

**Role of Wheat in Pullet Disease of Chickens**—That feeding wheat may be a predisposing cause of so-called pullet disease in chickens has been suggested at various times. A test was made by dividing an affected lot of birds into two flocks, one being continued on a scratch diet of wheat and the other flock being fed on a scratch diet of corn. Another lot of unaffected pullets commencing to lay was fed wheat. In both tests, the results were negative.

**Gas Fumigation of Used Baby Chick Boxes**—Many chick boxes are used over and over, partly as the result of temporary shortages in manufacture during 1942 and 1943. As a result, many newly hatched chicks shipped in used boxes are possibly exposed to infection with the pullorum organism. The feasibility of fumigating used boxes was tested by artificially contaminating them with *B. Pullorum* and giving them a double-strength, double-time fumigation in a standard forced draft incubator. The results were positive, since it was impossible to recover the organism after fumigation. Standard equipment available in the hatchery is capable, at low cost, of rendering used chick boxes safe for re-use from the standpoint of *B. Pullorum* contamination.

**Preventing Breast Blisters in Battery-Brooded Chickens**—Construction of the floor, particularly the diameter of the



wire and distance between wires, was found to be the major factor in controlling breast blisters. The larger the wire and the closer it is placed, the fewer are the breast blisters produced. There is a limitation, however, in the closeness of wire placement because wires must be far enough apart to prevent the toes of the chickens from being caught in the floor. It was found that wire having a minimum diameter of .098 inches, or approximately #10 B. & S. gauge, spaced  $\frac{1}{2}$ "x2", is effective in reducing commercially objectionable cases of breast blister from 43.7% to 6.9%. The 43.7% incidence of breast blisters was produced on wire of 22 gauge, spaced  $\frac{7}{8}$ " apart, only 1.2% of the birds being entirely free from breast blisters; when #10 wire, spaced  $\frac{1}{2}$ "x2", was used, 83.8% of the birds were free from breast blisters.

The standard of measurement was a crossbred chicken of either sex, 11 weeks of age, which had been kept upon the floor being tested for approximately 6 weeks.

More attention is being given to details of floor construction to further reduce the incidence of 6.9% of objectionable blisters.

## PUBLICATIONS

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Number	Title	Authors
A14 (Tech)	Effects of Waxing and Pre-Storage Treatments upon Prolonging the Edible and Storage Qualities of Apples.	{C. W. Hitz {L. C. Haut
A15	Labor Requirements for Selected Crops in Maryland.	{A. B. Hamilton {G. S. Abshier {S. H. DeVault
A16	The Broiler Industry in Maryland.....	{T. J. Davies {P. R. Poffenberger {S. H. DeVault
A17	Cost and Advisability of Raising Dairy Heifers.....	{Arthur M. Ahalt {A. B. Hamilton
A18	Wartime Prices and Agriculture.....	{P. R. Poffenberger {S. H. DeVault
A19	County Road Use and Finance in Maryland.....	W. Paul Walker
A20	Cattle Feeding Experiments—1938-1939, 1939-1940, 1940-1941, 1941-1942 .....	Fred H. Leinbach
A21	Community Organization in Charles County, Maryland .....	{Linden S. Dodson {Jane Woolley
A22	Curing and Storage of Maryland Golden Sweet Potatoes .....	{C. O. Appleman {Harold H. Shirk {P. H. Heinze {R. G. Brown
A23	Retail Prices and Quality of Canned Vegetables.....	{R. F. Burdette {S. H. DeVault {R. W. Akeley
A24	Pea Aphid Studies in Maryland.....	{L. P. Ditman {E. N. Cory {C. Graham {Albert White
A25	Trends in Wartime Farm Prices in Maryland.....	{P. R. Poffenberger {S. H. DeVault



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## Art. No.

- A31 Dietary Calcium and Phosphorus Levels and the Vitamin D Requirement of the Chick. J. S. Nowotarski and H. R. Bird. *Poultry Science*.
- A32 Chromosome Numbers in the Progeny of Triploid Gladiolus. R. E. Jones and Ronald Bamford. *American Journal of Botany*.
- A33 Chick Mash High in Soybean Oil Meal. H. R. Bird and A. C. Groschke. *Flour and Feed*.
- A34 Effect of Cyanide on Synthesis of Ring Spot and Mosaic Viruses in Tobacco. Mark W. Woods. *Phytopathology*.
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- A36a Edema in Vitamin Deficient Chicks. H. R. Bird. *Science*.
- A37 Haploids in Twin Seedlings of Capsicum Annuum. Hilde M. Christensen, Ronald Bamford. *Journal of Heredity*.
- A38 A Comparison of Different Methods of Determining the Exchangeable Cations of the Exchange Capacity of Maryland Soils. N. Gammon, L. B. Golden, R. P. Thomas.
- A39 A Method of Estimating the Organic Exchange Complex of a Soil. Carl W. Kelley and R. P. Thomas. *Proceedings of Soil Scientist of America*.
- A40 A Catena Arrangement of Maryland Soils. R. P. Thomas. *Proceedings of Soil Scientist of America*.
- A41 Cut-up Chicken Proportions and Prices. M. A. Jull, R. E. Phillips, C. S. Williams. *U. S. Egg and Poultry Magazine*.
- A42 Evidence for the Evolution of Phytopathogenic Viruses from Mitochondria and their Derivatives. Part I. Cytological & Genetic Evidence. Mark W. Woods and H. G. DuBuy. *Phytopathology*.
- A43 Chemical Evidence for the Evolution of Phytopathogenic Viruses from Mitochondria and Their Derivatives. Part II. Chemical Evidence. H. G. DuBuy and Mark W. Woods. *Phytopathology*.
- A44 Undercooling and Freezing of Insects. L. P. Ditman, George B. Vogt, Dwight R. Smith. *Journal of Economic Entomology*.
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- A46 Scion Rooting of Apple Grafts as Related to the Vegetativeness of the Scions Used. F. B. Lincoln.
- A47 The Activity of Microorganisms in the Transformation of Plant Materials in Soil Under Various Conditions. Howard L. Bodily. *Soil Science*.
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- A49 Is "Bluecomb" of Fowls Produced by Wheat? George D. Quigley.
- A50 Ovarian Response of Hens and Pullets to Injections of Ambion. R. E. Phillips. *Poultry Science*.
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- A57a Carotene Requirements for the Maintenance of a Normal Spinal Fluid Pressure in Dairy Calves. L. A. Moore and M. H. Berry (U. of Md.) and J. F. Sykes (Mich. State College). *Journal of Nutrition*.

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- A58a The Value of Kelp Meal in Rations for Dairy Cattle. M. H. Berry and K. L. Turk. *American Dairy Science Association*.
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- 10 Attacking the Soil Fertility Problems in Fruit Growing. A Lee Schrader. Yearbook of Commercial Fertilizer.
- 11 Labor Requirements and Capacity of Maryland Canneries. R. F. Burdette and S. H. DeVault. (Mimeo. circular).
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- 16 Machinery on Farms in Maryland. W. P. Walker, A. M. Ahalt, S. H. DeVault and P. R. Poffenberger. (Mimeo. circular).
- 17 Use of Spring Grown Seed Potatoes for Planting the Late Crop. R. A. Jehle. (Mimeo. circular).

## CURRENT PROJECTS

### AGRICULTURAL ECONOMICS

#### A-18. ORGANIZATION, OPERATION, AND BUSINESS ANALYSIS OF MARYLAND FARMS.

A-18-m. Balancing the Crop, Livestock and Equipment Investment.

A-18-p. Maryland Farm Statistics.

A-18-s. Housing Conditions and Facilities for Farm Labor in Maryland.

A-18-t. Farm Labor Requirements.

A-18-u. Farm Management Adjustments and Factors Encountered by Farmers in Attaining Increased Production in the Wartime Program.

#### A-19. THE FARM TAX PROBLEM IN MARYLAND.

#### A-26. MARKETING OF AGRICULTURAL COMMODITIES.

A-26-i. Maryland Farm Price Relationships.

A-26-j. The Effect of Changes in Transportation on Marketing Systems for Maryland Farm Products.

A-26-k. The Problem of Priorities and Rationing in Relation to Agricultural Production and Marketing in Maryland.

A-26-l. Prices Paid by Farmers for Commodities Bought.

A-26-m. Problems in Marketing Arising from the War Emergency.

### AGRICULTURAL ENGINEERING

R-7. A Study of Egg Coolers and Cooling Conditions.

R-9. Sweet Potato Curing and Storing.

### AGRONOMY

B-39. Wheat—Hybridization and Selection.

B-41. Barley—Hybridization for Smooth Awns.

B-42. Hay, Forage and Pasture.

B-43. Soybean Production in Maryland.

B-44. Sweet Corn—Seed Production and Breeding.

B-49. Improvement of Pastures in the Several Soil Provinces in Maryland.

B-50. Development of Dent Corn Hybrids Specifically Adapted to the Corn-Growing Areas of Maryland.

- B-52. Effects of Different Short Rotations on Physical, Chemical, and Pathological Conditions in the Soil and on Crop Production.
- B-53. Curing of Maryland Tobacco.
- O-27. Field Studies of the Fertility Requirements and Management of Important Soil Types in Maryland.
- O-28. Fertilizer Studies with Early Potatoes and Sweet Potatoes on Norfolk Sand.
- O-28-b. A Study of the Formula and Analysis for Late Potatoes.
- O-33. Efficiency of Soil Fertility Management.
- O-43. Hydrologic Studies with Reference to Soil Moisture Conservation, Soil Fertility, and Flood Control.
- O-44. A BIO-CHEMICAL-BIOLOGICAL STUDY OF MEANS TO INCREASE THE ORGANIC COLLOIDAL COMPLEX OF THE SOIL.
- O-44-a. A Study of the Chemical and Physical Changes Produced in a Soil by the Formation of the Organic Colloidal Complex.
- O-45. SOIL FERTILITY INVESTIGATIONS ON THE UNIVERSITY FARMS.
- O-45-a. Influence of Various Fertilizer Ratios on Crop Yields and Soil Conditions under Three Different Lime Levels.
- O-45-b. A Study of the Availability of Phosphate Material.
- O-46. A Study of Methods of Estimating the Available Potassium in Maryland Soils by the Rapid Soil Testing.
- O-47. The Available Supplies and Relative Agricultural Values of By-Product Liming Materials of Eastern Maryland.
- Production of Grain Sorghums.
- Tobacco Investigations. (Coop. with USDA.)
- The Improvement, Production, and Use of Rye in Maryland. (Coop. with Maryland Distillers.)

#### ANIMAL HUSBANDRY

- C-6. Study of the Factors Which Influence the Production of Cured Pork Products of Desirable Quality and Palatability.
- C-7. The Relative Net Energy Values of Barley in Comparison to Corn, and of Corn Silage in Comparison to Legume Hay When Fed in Fattening Rations to Steer Calves.

- C-8. Swine Breeding Investigations within the State of Maryland.
- C-9. Wintering Rations for Pregnant Ewes.

#### ANIMAL PATHOLOGY

- D-37. Running Fits (Canine Hysteria, Fright Disease) in Dogs.
- D-39. Bovine Pyelonephritis—Diagnosis, Treatment, and Control and Eradication.
- D-41. Periodic or Recurrent Ophthalmia of Horses and Mules—Field Studies.
- D-42. Diagnosis of Pregnancy in Mares.
- D-43. Streptococcic Septicemia of Horses and Mules.
- D-44. Bovine Trichomoniasis—Diagnosis, Treatment, Control and Eradication.
- D-45. Trichinosis—Diagnostic Methods.
- D-46. Bang's Disease—Calfhood Vaccination.
- D-47. The Development of Avirulent Immunizing Agents for Poultry Virus Diseases.

#### BACTERIOLOGY

- P-1. Microbiological Changes in Dehydrated Fruits and Vegetables.
- Q-58-d. Quality of Frozen Vegetables as Influenced by Methods of Handling of Raw Stock, Processing, Storage, and Utilization.
- R-1. THE INFLUENCE OF METHODS OF HANDLING ON THE MICROBIAL FLORA OF POULTRY AND POULTRY PRODUCTS, ETC.
  - R-1-b. The Influence of Different Microorganisms Upon the Quality of Frozen Egg Products.

#### BOTANY

- F-10. The Effect of Inducing Polyploidy on the Drug and Oil Content of Some Plants.
- F-11. The Occurrence and Use of Haploid Plants Resulting from Twin Seedlings of Pepper, Cantaloupe and Other Vegetable Plants of Importance to Maryland Growers.
- J-78. DISEASES OF FRUIT CROPS.
  - J-78-a. Breeding Strawberries for Resistance to the Red Stele Disease Caused by *Phytophthora fragariae* Hickman.



**J-80. DISEASES OF TRUCK AND CANNING CROPS.**

- J-80-a. Disease Resistance in Potatoes with Special Reference to Wilt and Late Blight.
- J-82. Processes Involved in Multiplication of Viruses in Living Suscept Cells.
- K-7. Physiological and Biochemical Aspects of Vegetable Storage.
- K-22. The Relation Between Vernalization and the Activities of Plant Growth Regulators, Flowering Substances, etc.

**DAIRY HUSBANDRY**

- G-11. Growth Data of Dairy Animals from Birth to Freshening Age.
- G-17. The Effect of Feeding Kelp Meal Upon Improving the Breeding Efficiency of Dairy Cattle.
- G-26. The Feeding Value of Cheat for Dairy Cows.
- G-27. The Vitamin A and Carotene Requirements of Dairy Cows.
- G-28. Normal Age Variations of the Intra-ocular Tension of Dairy Cattle.
- G-29. The Effects of Vitamin A Deficiency on the Central Nervous System of Dairy Calves.
- G-30. Reproductive Efficiency in Dairy Cattle.
- G-31. Dry Starters for Dairy Calves.
- G-32. The Effect of Conditions of Storage Upon the Conservation of the Vitamin Content of Whole Milk Powder.

**ENTOMOLOGY**

- H-29. INVESTIGATIONS OF THE BIOLOGY AND CONTROL OF INSECTS AFFECTING CANNING CROPS.
  - Sub. 2. Biology and Control of the Corn Earworm.
  - Sub. 3. Biology and Control of the Pea Aphid.
  - Sub. 5. Timing of Pea Aphid Treatments.
- H-35. Nursery Insects.
- H-40. BIOLOGY AND CONTROL OF TOBACCO INSECTS.
  - Sub. 1. The Tobacco Horn Worms.
- H-41. Biology and Control of Japanese Beetle.
- H-42. Ecological and Physiological Factors Concerned with the Hibernation of Insects.
- H-43. The Biology and Control of the European Corn Borer under Maryland Conditions.

- H-44. Disease Resistance of Selected Strains of Honeybees.
- H-45. Practicability of Migratory Bee-keeping in Maryland.
- H-46. Concentrated Sprays.

### HORTICULTURE

- E-1. VEGETATIVE PROPAGATION WITH SPECIAL REFERENCE TO CUTTINGS.
  - E-1-g. Propagation with Special Reference to Fruits and Ornamentals.
- E-2. The Effect of Rootstocks on the Production and Quality of Apples.
- L-67. A STUDY OF FACTORS INFLUENCING COLOR IN APPLES.
  - L-67-a. Red Color Development on Red Strains (Bud Sports) of Commercial Apple Varieties.
- L-68. Factors Affecting Maturity, Shipping and Storage Quality of Fruits.
- L-72. Relation of Soil Moisture, Age of Plants, etc., to Flower Differentiation and Quality of the Strawberry.
- L-73. ADAPTATION OF FRUIT VARIETIES AND NEW SEEDLINGS TO MARYLAND.
  - L-73-a. The Growth and Fruiting Behavior of New Fruit Varieties, Strains and Seedlings.
- L-74. ENVIRONMENTAL FACTORS AND CULTURAL PRACTICES IN RELATION TO THE GROWTH AND FRUITING RESPONSES OF FRUITS.
  - L-74-a. The Maintenance of Annual Bearing of Apple Varieties.
  - L-74-b. The Relationship of Early Bearing to Subsequent Growth and Fruiting Behavior of Apple Varieties
  - L-74-c. Factors Associated with the Productiveness and Unproductiveness of the Delicious Apple.
  - L-74-d. The Pruning of Raspberries in Relation to Growth and Fruiting Behavior.
- L-76. A Diagnosis of Certain Abnormalities in Growth and Fruiting of Peaches in Maryland.
- Q-58. FACTORS INFLUENCING YIELD AND QUALITY IN THE PRODUCTION AND PROCESSING OF VEGETABLES.
  - Q-58-a. The Influence of Fertilizer Placements and Analyses on the Yield and Quality of Vegetables Grown for Processing.
  - Q-58-e. Dehydration of Horticultural Crops.

- Q-67. The Value of Organic Matter in the Production of Vegetable Crops.
- Q-74. A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland.
- Q-75. The Effect of Certain Factors on the Growth of Tomato Plants and the Quality of the Fruit.
- Q-76. BREEDING AND GENETICS OF VEGETABLE CROPS.
- Q-76-a. Breeding New Strains of Vegetable Crops.
- Q-76-b. Breeding Disease Resistant Strains of Vegetable Crops.
- Q-76-c. Breeding and Selection of a Fruitful Type of Lima Bean for Maryland.
- Q-77. Crop Management Studies with Vegetable Crops.
- Q-78. Physiological Effects of Sprays and Dusts on Cantaloupes, Especially in Relation to Defoliation, Vine Growth, etc.

#### POULTRY

- M-32. PHYSIOLOGY OF REPRODUCTION IN POULTRY.
- M-32-c. Endocrine Studies in Poultry.
- M-32-d. Hatchability Studies in Poultry.
- M-33. FACTORS AFFECTING QUALITY OF POULTRY PRODUCTS.
- M-33-b. Determining Relative Proportion of Different Parts of "Cut-up" Chicken as Marketed and Price Relationship Between Drawn and Cut-up Chicken.
- M-34. THE EFFICIENCY OF POULTRY IN THE UTILIZATION OF FEED.
- M-34-d. By Progeny-test Selection and Breeding Methods, Developing Strains of Purebred and Crossbred Poultry Excelling in Efficiency of Feed Utilization in Both Egg and Meat Production.
- M-34-dd. By Progeny-test and Breeding Methods, Developing a Strain of Turkeys Excelling in Efficiency of Feed Utilization in Meat Production.
- M-35. NUTRITIVE REQUIREMENTS OF POULTRY.
- M-35-a. The Place of Soybean Meal in Poultry Rations.
- M-35-e. Phosphorus Requirement of the Chick as Affected by Source of Phosphorous and Vitamin D Intake.
- M-35-f. Variability of the Feeding Value of Soybean Oil Meals.

**M-36. VIABILITY OF MARYLAND POULTRY.**

- M-36-b. Resistance to Pullorum Disease in Chickens.
- M-36-c. Making Histological Tissue Sections of Material from Leucotic Fowls for Positive Identification of Disease.
- M-36-d. Developing a Possible Test for the Presence of Avian Leucosis.
- M-36-e. The Role of Wheat in Pullet Disease of Chickens.
- M-38. Gas Fumigation for Used Baby Chick Boxes.
- M-39. The Value of Sulphur as a Soil Disinfectant for Poultry, Including Turkeys.

**CHANGES IN PERSONNEL****Appointments:**

- Anna Ferguson, Assistant Seed Analyst, March 15, 1943.
- James E. Hawes, Assistant in Horticulture, April, 1943.
- Mary Juhn, Associate Professor, Poultry Husbandry, October 1, 1942.
- Amihud Kramer, Assistant in Horticulture, March 1, 1943.
- M. A. Petty, Instructor, Plant Pathology, January 1, 1943.
- L. E. Scott, Assistant in Pomology, October 1, 1942.
- William A. Seleen, Assistant Professor, Bacteriology, February 1, 1943.
- Miye Yamasaki, Assistant in Soils, June, 1943.

**On Leave**

- Jack Amatt, Instructor, Horticulture, February 15, 1943.
- H. G. DuBuy, Assistant Professor, Plant Physiology, February 1, 1943.
- James M. Gwin, Associate Professor, Poultry, June 6, 1941.
- Chester W. Hitz, Assistant Pomologist, June 1, 1942.
- A. D. Hoadley, Instructor, Agronomy, December 24, 1942.
- Glenn T. Hoffman, Assistant Dairy Inspector, February 28, 1943.
- R. E. Jones, Instructor, Botany, February 15, 1943.
- John T. Mullady, Seed Analyst, April 16, 1942.
- H. G. Shirk, Assistant Professor, Plant Physiology, May 21, 1941.
- Howard Stier, Assistant Professor, Horticulture, July 1, 1941.
- Mark W. Woods, Assistant Professor, Plant Pathology, January 31, 1943.

**Resignations:**

- Dean M. Bailey, Instructor and Assistant Olericulture, April 30, 1943.
- Clyde Bean, Assistant Professor, Animal Pathology, June 30, 1943.
- Roger F. Burdette, Assistant Agricultural Economist, March 21, 1943.
- Ellen P. Emack, Assistant Seed Analyst, March 15, 1943.
- H. S. McConnell, Associate Professor, Entomology, May 3, 1943.
- William A. Seleen, Assistant Professor, Bacteriology, June, 1943.
- Wilson L. Smith, Jr., Assistant, Plant Pathology, August 31, 1942.

# FINANCIAL STATEMENT—July 1, 1942 to June 30, 1943

FIFTY-SIXTH ANNUAL REPORT

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FEDERAL FUNDS				
	Hatch	Adams	Pernell	Bankhead-Jones
Balance June 30, 1942.....				
Appropriations 1942-43.....	\$15,000.00	\$15,000.00	\$60,000.00	\$30,259.72
Receipts from sources other than Federal 42-43:				
State appropriations for agricultural investigations.....				
Industrial Grants.....				
Sales.....				
				For Agr. Investigations* \$ 88,161.56 6,224.34 68,292.66
Balance brought forward July 1, 1942.....				\$162,678.56 47,329.36
Total.....				\$210,007.92
Expenditures:				
Personal Services.....	\$12,486.66	\$11,606.63	\$45,806.49	\$ 62,515.65
Travel.....	279.70		1,682.53	3,280.89
Transportation of Things.....	42.36	1.61	61.40	661.75
Communication Service.....	46.65	39.92	141.34	1,581.31
Rents and Utility Service.....	4.50		151.13	1,773.51
Printing and Binding.....			2,185.09	1,263.87
Other Contractual Services.....	117.48	99.46	149.37	5,160.48
Supplies and Materials.....	1,787.47	1,645.81	6,018.88	59,146.45
Equipment.....	204.38	953.97	3,803.77	14,903.92
Lands and Structures.....	30.80	652.60		8,111.37
Contributions to Retirement.....				8,475.00
Total expenditures.....	\$15,000.00	\$15,000.00	\$60,000.00	\$166,874.20
Balances June 30, 1943.....				43,133.72
Totals.....	\$15,000.00	\$15,000.00	\$60,000.00	\$210,007.92

\*Including Bankhead-Jones Offset Funds.







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WASH. STATE DEPT. OF AGRICULTURE  
UNIVERSITY OF WASHINGTON  
PULLMAN, WASH.

DO NOT CIRCULATE

DO ~~REDACTED~~ CIRCULATE

